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Working Paper

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HUMAN FACTORS AND SAFETY OBSERVATIONS REGARDING THE AIR POWERED TOOL SET (APTS)

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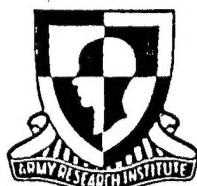
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**Human Factors and Safety Observations Regarding
the Air Powered Tool Set (APTS)**

1. At request of the TEXCOM Training and Support Systems Test Directorate (TSSTD), the Fort Hood Field Unit of the Army Research Institute agreed to conduct a brief field evaluation of the Army's Air Powered Tool Set (APTS) in conjunction with the APTS Concept Evaluation Program. TSSTD requested that ARI human factors specialists observe the use of the APTS by the test units and provide comments regarding human factors characteristics of the system. Both the heavy APTS and the light APTS were to be observed and commented on.

2. The heavy APTS that was observed consisted of a compressor which was not in operation because of a malfunction, one air gun in operation powered by the installation compressor, and assorted attachments and tool boxes located in the supply room. The light APTS that was observed consisted of a compressor not in operation and tool boxes situated in a maintenance truck.

3. ARI provided two human factors psychologists to observe the systems. Accompanied by CPT Anthony Lujan and SGT Spicer of TSSTD, Drs. Charles Nystrom and Norman Smith visited two motor pool locations where the heavy and light APTSs and operators were provided.

4. The two ARI observers were requested to comment specifically on a series of questions listed on FH Form 2974. The questions and ARI comments are as follows:

2974-1: Are all controls to the Air Powered Tool Set (APTS) easily accessible?
Yes.

2974-2: Are controls properly labeled? Labels were not observed on or near the tool controls or on the air hoses. There were a few engraved/etched on-off symbols and indicators of the direction of turning to increase power.

2974-3: Are controls functionally located to enhance ease of operation? Control locations appeared to be standard and supported operational use. Whether or not the locations "enhanced" use is arguable.

2974-4: Is the system's response to a control input suitably quick? Yes.

2974-5: Do knobs/switches indicate power settings? Indicators were sometimes present - a clockwise pointing arrow symbol was pressed into the socket driver near a turnable rod to indicate the direction for increasing torque.

2974-6: Are controls color coded and do the codes employed follow established conventions? No color coding of controls was present.

2974-7: Are labels easy to read and understand? They were seldom present. Labels were observed on the underside of the tool box lid and on the side of a cylindrical oil-air mixer. They were easy to read, but the mixer label cautioned against over-filling without telling the consequence.

2974-8: Are controls located so that they are not susceptible to being moved accidentally? There was no trigger guard on the socket driver trigger, so it was susceptible to inadvertent depression (activation).

2974-9: Do the controls rotate clockwise for increase and counter-clockwise for decrease of power settings? Yes.

2974-10: Are signs posted warning personnel to wear hearing protection? No such signs were observed; however a large wall-mounted rack of "ear-muffs" showed their availability and implied their need.

2974-11: Are signs posted warning personnel to wear eye protection? No such signs were observed.

2974-12: Have personnel been briefed not to wear loose clothing while operating the power tools? Captain Lujan reports that they had been so briefed.

2974-13: Is there adequate maintenance workspace? Yes, there was adequate space for the number of vehicles occupying the workspace.

2974-14: Are the APTS tool chests labeled "HEAVY LIFT"? No.

2974-15: Do the tool chests have built-in handles? Yes.

2974-16: Are protective guards provided for moving parts of machinery on the compressor? It was pointed out that one protective screen rotates while the compressor is operating, and so comprises a (reduced) hazard itself.

2974-17: Are "carbon monoxide fumes" warning signs posted on or near the compressor? No signs warning of carbon monoxide fumes were evident.

2974-18: Are air hoses clearly labeled as to contents? No. Air and other hoses were not labelled as to content.

2974-19: Do air hoses create a tripping hazard? The observation period was too brief to permit an assessment that the hoses would never comprise a tripping hazard.

2974-20: Can the compressor be refueled safely? Did not observe a refueling; personnel assert that safe refueling is readily accomplished.

2974-21: Is the fuel tank easily accessible? Yes.

2974-22: Are personnel verbally warned, signs displayed, or protective guards employed to keep operators from getting burned on hot engine parts? No signs warning of hot engine parts were observed.

5. In addition, comments were solicited and provided as follows:

- a. The air pressure gauge on the compressor has no shading (red or otherwise) to indicate that the indicator needle is entering excessively high levels of pressure.

- b. The warning label on the compressor pressure gauge was not readable.
- c. The oil filter/regulator gauge has no warning sign or gauge marking.
- d. The guard on the compressor motor rotates; needs warning marking or an alternative, non-rotating protective cover.
- e. On both large and small compressors (17 CFM and 8 CFM) the 12VDC battery was a separate, non-integrated component. In one case it was strapped to the compressor body; in another it sat loose beneath the compressor. An integrated battery bracket is needed. Leads to the battery for the 8 CFM system were not marked as to polarity.
- f. A large socket driver air "gun" was observed at a work site; it was liberally coated with oil and required careful handling to avoid its slipping when being manipulated. The oil came from the vehicle engine rather than from the oil supplied via air line to the air powered tool. The direction selector (clockwise & counter-clockwise) is not marked. The only way to determine the direction of rotation is by turning on the gun and observing the rotation.
- g. There was insufficient tool chest space with both systems. Extra boxes had to be found to store the tools, and to organize the tools for simpler distribution and return.
- h. The tool chest that was provided is heavy for two men when loaded. There were no clearly visible markings on outside of chest warning of a "Heavy Lift."
- i. There are handles on each end of tool chest which protrude. Recessed handles are desirable.